

Equivalency Criteria

- ***Regulations (40 CFR.221 (d))***
 - ***Prevent migration of hazardous constituents into the groundwater of surface water at least as effectively as the standard liner system.***
 - ***Allow leak detection through the top liner at least as effectively as the standard liner system.***
- ***Other Technical Criteria (Koerner and Daniel (1993))***
 - ***Hydraulic (leakage rate, steady flux)***
 - ***Physical/Mechanical (freeze-thaw, wet-dry)***
 - ***Construction/Operations (leak monitor, maintenance and repair)***

Equivalency Analysis

- ***Primary lining system***
 - ***Alternative exceeds requirements of standard design (40 CFR 264.221)***
 - ***Double geomembrane with GCL vs. Single geomembrane***
- ***Secondary Lining System***
 - ***GCL vs. CCL with drastically reduced leakage potential with alternative***

Summary of Equivalency Analysis

- Primary lining system provides superior leakage protection and ability to access and monitor leaks**

Leakage Rate Calculations for Geomembrane Defect.

Liner system	Standard / Alternate	Leakage Rate (gpad)	Design Condition
Primary	Standard	8,325	Large defect
	Standard	261	Small defect
	Alternate	1.8 to 9.8	Large defect; good to poor contact
	Alternate	1.3 to 6.9	Small defect; good to poor contact
Secondary	Standard	3.6×10^{-3} to 2.0×10^{-2}	Large defect; good to poor contact
	Standard	2.5×10^{-3} to 1.4×10^{-2}	Small defect; good to poor contact
	Alternate	4.2×10^{-4} to 2.3×10^{-3}	Large defect; good to poor contact
	Alternate	3.0×10^{-4} to 1.6×10^{-3}	Small defect; good to poor contact

**** Action Leakage Rate for surface impoundment based on EPA guidance is approximately 1000-2000 gpad.**

Summary of technical equivalency assessment for secondary evaporation pond lining system.

Issue	Criteria for Evaluation	Category 1	Category 2	Category 3	Category 4
Hydraulic	Steady flux of water	X			
	Leakage rate	X			
	Horizontal flow	X			
	Attenuative capacity		X		
Physical/Mechanical	Freeze-thaw	X			
	Wet/dry	X			
	Erosion vulnerability	X			
Const./Operations	Speed of construction	X			
	Puncture resistance			X	X
	Weather constraints	X			
	Water requirements	X			
	Access maintenance and repair	X			

- *The Alternative is more effective (Category 1)*
- *The Alternative is equivalent (Category 2)*
- *The Alternative is not equivalent (Category 3)*
- *Site-specific design, operation, or QA/QC conditions to make each alternative equivalent or superior (Category 4).*

Conclusions of Equivalency Analysis

- ***Clear superiority of alternative primary lining system with overall superiority of alternative secondary lining system demonstrate that the alternative is at least equivalent to the standard design.***

Key Advantages of the Alternative Design:

- ***A redundant composite primary liner system, which is more protective against leakage.***
- ***The CCL component of the standard design cannot provide resistance to freeze/thaw cycles without potential compromise of performance and integrity, or without protective layers over the liners that would impair functionality or serviceability, or increase waste generation.***
- ***The primary liner system can be readily accessed for maintenance and repair.***
- ***There will be no contaminated soil requiring disposal either during periodic replacement of the operations layer or at the time of evaporation pond closure.***
- ***Leakage from the primary lining system surface can be easily monitored and repaired as needed.***

IDEQ/EPA Comments and Issues

- ***Unconfined (Free) Swell***
- ***Freeze-Thaw Resistance***
- ***Attenuation provided by CCL***
- ***HDPE as selected geomembrane material***